

THE 250MEV-INJECTOR-TESTFACILITY FOR SWISSFEL

K.Dreyer, T.Höwler, Paul Scherrer Institute (PSI), Villigen, Switzerland

Abstract

The PSI SwissFEL project requires the implementation of advanced technologies. Many of the planned components are prototypes. To guarantee operation of SwissFEL the PSI has build up the 250MeV-Injektor-Testfacility in 2009. By the use of this injector we get the chance to test new systems, components and materials. We can also develop beam- and installation procedures. The testfacility allows tests for feasibility and alignment concepts.

The 250MeV-Injektor-Testfacility is in operation since August 2010 and was upgraded and optimized several times. In March 2012 the beam energy of 250MeV has been reached.



Figure 1: Tunnelview in 2012

COMPONENTS & LAYOUT

For the construction of the accelerator a new hall with a length of approx. 80 m has been built in 2009. The installation of the machine has been done in 3 phases. In phase 1 the gun and diagnostics has been installed and tested, in phase 2 the booster has been commissioned. In the 3rd phase the injector has been completed including a bunch compression chicane for full injector characterization and compression studies. By the end of 2012 the installation of a SwissFEL prototype undulator is foreseen.

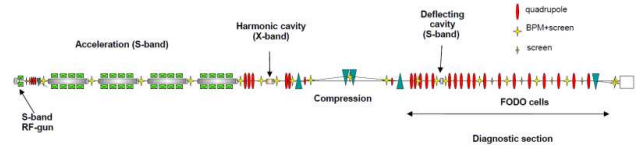


Figure 2: Full injector (03/2012)

THE NETWORK

After finishing the construction and installation of the approx. 100 conic 1.5''-fiducials into the floor and at the tunnel wall (2009) we started the measurements of the alignment-network. At first we measured the main network in the inside and the outside part of the main hall (Figure 3). For this task we used our lasertracker LEICA LTD800/level Nivel20 and also optical instruments (level WILD N3/ LEICA TDA5005). The combined network calculation has been done in WinGeonet (SLAC).



Figure 3: network-session in 2009 (opened tunnel-roof)

After the tunnel-roof has been closed and the shielding walls were completed we re-measured and updated the whole tunnel-network.

This network has been re-checked and has been improved in 2012 (Figure 5). With the combined measurements of our new lasertracker LEICA AT901 and the leveling data of WILD N3 and Nivel20 we have reached an accuracy of about RMS of 0.02 mm for our network reference points. Our field measurement software

LEICA AXYZ has been replaced by SpatialAnalyzer (NewRiverKinematics).

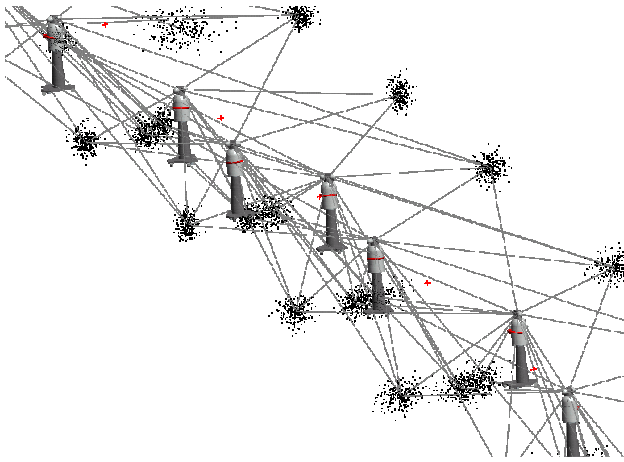


Figure 4: Tunnel-network configuration (check 2012)

THE GIRDER-SHIMMING CONCEPT

The different components has been aligned on mineral cast girders. In a first step we measured the reference surfaces of these girders in a designated area outside of the tunnel. Two surfaces as vertical reference and one for transversal position has been referenced to the 9 fiducials (0.5'' cones) as a base for the further alignments in tunnel.

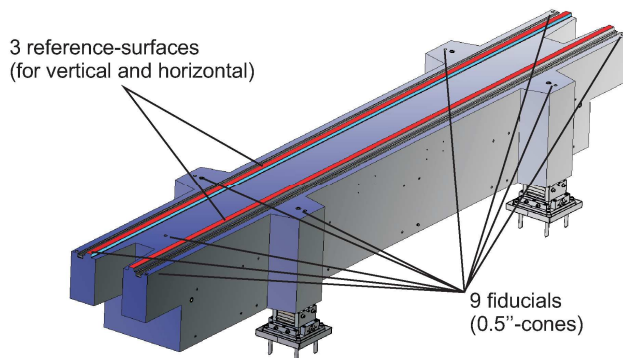


Figure 5: Mineral cast girders and reference-surfaces

The individual components have been installed with shimming blocks of a default thickness of 20mm. During the final alignment the separate components were aligned by the use of matching shimming blocks and precise metal foils.

At the beginning of every installation phase the network has been re-checked.

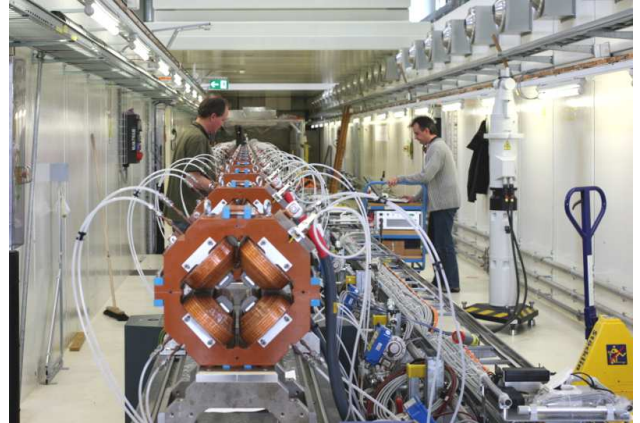


Figure 6: Final alignment of diagnostik section (FODO)

REFERENCES

- [1] M. Pedrozzi (ed.), *SwissFEL Injector Conceptual Design Report*, PSI Report PSI-10-05
- [2] M. Pedrozzi et al., *250 MeV Injector Facility for the SwissFEL Project*, in Proceedings of the 31st International Free Electron Laser Conference (FEL), Liverpool, UK, 2009
- [3] https://intranet.psi.ch/Swiss_FEL/FinOverview
- [4] T. Schietinger, M. Aiba, S. Bettoni, B. Beutner, M. Csatari Divall, K. Doshekenov, Y.-C. Du, M. Guetg, C.P. Hauri, R. Ischebeck, F. Le Pimpec, N. Milas, G.L. Orlandi, M. Pedrozzi, P. Peier, E. Prat, S. Reiche, B. Smit, A. Trisorio, C. Vicario, *PROGRESS REPORT ON THE SwissFEL INJECTOR TEST FACILITY*